

PTO 08-2572

CC = JP
20020322
Kokai
14081202

ELEVATING WORK PLATFORM AND METHOD FOR ASSEMBLING/DISASSEMBLING IT
[Sagyoyo shoko ashiba oyobi sono kumitate/kaitai hoho]

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UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. FEBRUARY 2008
TRANSLATED BY: THE MCELROY TRANSLATION COMPANY

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|---|--------|--|
| PUBLICATION COUNTRY | (19): | JP |
| DOCUMENT NUMBER | (11): | 14081202 |
| DOCUMENT KIND | (12): | Kokai |
| PUBLICATION DATE | (43): | 20020322 |
| APPLICATION NUMBER | (21): | 12194066 |
| APPLICATION DATE | (22): | 20010627 |
| INTERNATIONAL CLASSIFICATION ⁷ | (51): | E 04 G 1/20 1/36 F 22 B 37/02 F 23 G 5/00 // F 23 M 5/00 |
| PRIORITY NUMBER | (31): | 12194067 |
| PRIORITY DATE | (32): | 20000628 |
| PRIORITY COUNTRY | (33): | JP |
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| TITLE | (54): | ELEVATING WORK PLATFORM AND METHOD FOR ASSEMBLING/DISASSEMBLING IT |
| FOREIGN TITLE | [54A]: | Sagyoyo shoko ashiba oyobi sono kumitate/kaitai hoho |

1. An elevating work platform that is assembled/disassembled inside of a boiler furnace, wherein the elevating work platform is characterized in that it is configured with a work floor that is installed temporarily inside of the boiler furnace, a mast assembly that is comprised of multiple extension masts and installed on said work floor in a detachable fashion, an elevating stage that is hoisted in the axial direction of said mast assembly, driving frames that are each equipped with a drive unit at each extension mast so as to hoist the elevating stage attached to [the driving frames] by means of a rack-and-pinion hoist mechanism, and a controller.

2. An elevating work platform that is assembled/disassembled inside of a garbage incinerator or inside of a garbage incinerator boiler and a boiler that is connected to said [garbage incinerator], wherein the elevating work platform is characterized in that the aforementioned elevating work platform is configured with a work floor that is installed temporarily inside of a garbage incinerator or inside of a garbage incinerator boiler and a boiler, a mast assembly that is comprised of multiple extension masts and installed on said work floor in a detachable fashion, an elevating stage that is hoisted in the axial direction of said mast assembly, driving frames that are each equipped with a drive unit at each extension mast so as to hoist the elevating stage attached to [the driving frames] by means of a rack-and-pinion hoist mechanism, and a controller.

3. The elevating work platform described in Claim 1 or 2, characterized in that the assembled mast is configured with a pair of extension masts.

4. The elevating work platform described in Claim 1, characterized in that the assembled mast is configured with 4 extension masts.

5. A method for assembling/disassembling an elevating work platform inside of a boiler furnace, wherein the elevating work platform assembling/disassembling method is characterized in that multiple

* [Numbers in right margin indicate pagination of the original text.]

masts are installed in a detachable fashion on a work floor that is installed temporarily inside of the aforementioned boiler furnace, frames equipped with drive units are attached to said masts, an elevating stage is attached to said frames via brackets, the elevating stage is hoisted in the axial direction of the masts by the drive units by means of a rack-and-pinion hoist mechanism, a mast assembly of a prescribed height is constructed by adding masts one by one, and an elevating work platform is assembled; and after a task is completed using said elevating work platform, the elevating stage is lowered, the extension masts are removed one by one, and the elevating work platform is disassembled.

6. A method for assembling/disassembling an elevating work platform inside of a garbage incinerator or inside of a garbage incinerator boiler and a boiler that is connected to said [garbage incinerator], wherein the elevating work platform assembling/disassembling method is characterized in that multiple masts are attached to a work floor that is installed temporarily inside of the garbage incinerator or inside of the garbage incinerator boiler and the boiler that is connected to said [garbage incinerator], frames equipped with drive units are attached to said masts, an elevating stage is attached to said frames via brackets, the elevating stage is hoisted in the axial direction of the masts by drive units by means of a rack-and-pinion hoist mechanism, a mast assembly of a prescribed height is constructed by adding masts one by one, and an elevating work platform is assembled; and after a task is completed using said elevating work platform, the elevating stage is lowered, the extension masts are removed one by one, and the elevating work platform is disassembled.

7. The elevating work platform assembling/disassembling method described in Claim 5, characterized in that a pair of masts are attached in a detachable fashion to the work floor that is installed temporarily inside of the boiler furnace, the frames equipped with the drive units are attached to said masts, the elevating stage is attached to said frames via the brackets, the elevating stage is hoisted in the axial direction of the masts by the drive units by means of a rack and pinion mechanism,

the mast assembly of a prescribed height is constructed by adding the masts one by one while connecting them to the furnace walls at fixed intervals, and the elevating work platform is assembled.

8. The elevating work platform assembling/disassembling method described in Claim 5, characterized in that 4 masts are attached in a detachable fashion to the work floor that is installed temporarily inside of the boiler furnace, the frames equipped with the drive units are attached to said 4 masts, the elevating stage is attached to said frames via the brackets, the elevating stage is hoisted in the axial direction of the masts by the drive units by means of a rack and pinion mechanism, a mast assembly of a prescribed height is constructed by adding the masts one by one, and the elevating work platform is assembled.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to an elevating work platform to be used for inspection, repair, and such cleaning as clinker removal of inner walls of a boiler furnace or a garbage incinerator and a method for assembling/disassembling it.

[0002]

Prior art

For example, in the case of industrial boilers, such as a large boiler for thermopower generation, operations are suspended for the purposes of inspection, repair, and such cleaning as clinker removal of inner walls of a furnace. Once operations of a boiler is stopped, and the inside of the furnace cooled down, materials are brought into the furnace to build a scaffold in order to inspect, repair, and undertake such cleaning as clinker removal of the furnace walls.

[0003]

However, a large quantity of materials are required for scaffolding, and those materials are carried in through a small maintenance hatch created on a boiler hopper before they are assembled. Then, once the inspection, repair, and clinker removal cleaning are finished, the scaffold is disassembled, and the disassembled materials are carried out through the maintenance hatch.

[0004]

In the meantime, there is the tendency that boilers themselves are becoming larger; for example, several 10s of meters in height, or even close to 100 m high in some cases.

[0005]

As such, the current situation is that it takes 1 week to 10 days for building the scaffold and as many as 5-6 days for its removal, and improvement of the work efficiency is in great demand.

[0006]

As an example measure to handle this situation, Japanese Kokai Patent Application No. Sho 61[1986]-14362 suggests that a scaffold is installed in a hoistable fashion using such a suspension means as wire ropes in order to reduce the quantity of materials to be brought into a furnace while the scaffold itself is configured into a 1-stage flat structure in order to allow mechanical power to be incorporated.

[0007]

Figure 11 is a cross-sectional view of a conventional in-furnace scaffolding device, and Figure 12 is a cross-sectional view along the A-A line in Figure 11.

[0008]

As shown in Figure 11 and 12, boiler main unit 1 has a structure in which a boiler retention steel frame that surrounds the boiler is suspended from ceiling joist 2 in order to allow thermal deformation of the furnace. Work platform 3 as the main body of the device is suspended using wire ropes 4, and the other ends of the wire ropes are supported by ceiling joist 2. Several wire rope take-up drums 6 are attached to the side surfaces of work platform 3, and work platform 3 is hoisted and lowered by adjusting the wire rope take-up amount by said drums 6. In addition, anti-rocking members 5 are attached to the side surfaces of work platform 3, and they are brought into contact with the side surfaces of the furnace at the other end in order to prevent work platform from rocking.

[0009]

When the aforementioned scaffolding device is utilized, the quantity of components to be brought into the furnace while the boiler is stopped is extremely small, and they can be assembled easily also. In addition, clinker adhered to water pipe walls 7 of the furnace may be removed manually or automatically using robot 8. Reference numeral 9 represents a manipulator, and 10 represents a rail.

[0010]

Problems to be solved by the invention

However, the technology disclosed in aforementioned Japanese Kokai Patent Application No. Sho 61[1986]-14362 has the following problems.

[0011]

According to the configuration, work platform 3 is suspended using wire ropes 4, and the other ends of wire ropes 4 are supported by ceiling joist 2. Thus, multiple small holes for running wire ropes through have to be created in the water pipe wall that constitutes the ceiling of the furnace. The operation of creating the small holes requires a high-elevation work, and that it is complicated.

[0012]

In addition, the anti-rocking members are attached to the side surfaces of work platform 3, and they are brought into contact with the side surfaces of the furnace at the other end [to prevent rocking]. However, because work platform 3 is suspended by multiple wire ropes 4, and it is hoisted by take-up drums 6 for wire ropes 4, it takes a long time to hoist [the work platform] evenly, and it is difficult to prevent rocking entirely.

[0013]

In addition, when work platform 3 that surrounds near the inner walls of the furnace was divided, and work platform 3 is suspended and hoisted in sections using wire ropes 4, good balance is even more difficult to achieve when work platform 3 near the entire circumference of the inner walls of the furnace are hoisted at once, so that rocking is more likely to be intensified.

[0014]

In addition, because suspension-type work platform 3 is subject to the risk of falling, extreme care needs to be taken during the assembling/disassembling work. Thus, it takes longer than necessary.

[0015]

The same problems take place inside of a garbage incinerator or inside of a boiler (waste-heat boiler) connected to a garbage incinerator.

[0016]

The aforementioned problems are solved by the present invention, and its purpose is to present a work platform that involves less high-elevation work, no rocking, a lighter weight than other scaffolds, a reduced quantity of components to achieve a reduced work time, and simple and quick assembling/disassembling and a method for assembling/disassembling it.

[0017]

Means to solve the problems

The invention in Claim 1 is an elevating work platform that is assembled/disassembled inside of a boiler furnace, wherein the elevating work platform is characterized in that it is configured with a work floor that is installed temporarily inside of the boiler furnace, a mast assembly that is comprised of multiple extension masts and installed on said work floor in a detachable fashion, an elevating stage that is hoisted in the axial direction of said mast assembly, driving frames that are each equipped with a drive unit at each extension mast so as to hoist the elevating stage attached to [the driving frames] by means of a rack-and-pinion hoist mechanism, and a controller.

[0018]

The invention in Claim 2 is an elevating work platform that is assembled/disassembled inside of a garbage incinerator or inside of a garbage incinerator boiler and a boiler that is connected to said [garbage incinerator], wherein the elevating work platform is characterized in that the aforementioned

elevating work platform is configured with a work floor that is installed temporarily inside of a garbage incinerator or inside of a garbage incinerator and a boiler, a mast assembly that is comprised of multiple extension masts and installed on said work floor in a detachable fashion, an elevating stage that is hoisted in the axial direction of said mast assembly, driving frames that are each equipped with a drive unit at each extension mast so as to hoist the elevating stage attached to [the driving frames] by means of a rack-and-pinion hoist mechanism, and a controller.

[0019]

According to the invention pertaining to Claim 1 or 2, because the driving frames, that are each equipped with the drive unit at each extension mast so as to hoist the elevating stage attached to [the driving frames] by means of a rack-and-pinion hoist mechanism, are provided, the drive units and the controller are manipulated to hoist the driving frames so as to hoist the elevating stage installed as one body with the driving frames in the axial direction of the masts, the mast assembly of the prescribed height is constructed by adding masts one by one, and the elevating work platform is assembled; and after the work is completed using said elevating work platform, the elevating stage is lowered, the extension masts are removed one by one, and the elevating work platform is disassembled.

[0020]

The invention in Claim 3 is characterized in that in the invention described in Claim 1 or 2, the assembled mast is configured with a pair of extension masts.

[0021]

When the assembled mast is configured with a pair of extension masts, the elevating stage is hoisted in the axial direction of the masts, the mast assembly of the prescribed height is constructed by adding

the masts one by one while connecting them to the furnace walls at fixed intervals, and the elevating work platform is assembled; and after the work is completed using said elevating work platform, the elevating stage is lowered, the extension masts and the connections to the furnace walls are removed one by one, and the elevating work platform is disassembled.

[0022]

The invention in Claim 4 is characterized in that in the invention described under Claim 1, the assembled mast is configured with 4 extension masts.

[0023]

According to this invention, the mast assembly comprising the 4 extensions masts is installed without any connection with the furnace walls, the elevating work platform is assembled; and after the work is completed using said elevating work platform, the elevating stage is lowered, the extension masts are removed one by one, and the elevating work platform is disassembled.

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[0024]

The invention in Claim 5 is a method for assembling/disassembling an elevating work platform inside of a boiler furnace, wherein the elevating work platform assembling/disassembling method is characterized in that multiple masts are installed in a detachable fashion on a work floor that is installed temporarily inside of the aforementioned boiler furnace, frames equipped with drive units are attached to said masts, an elevating stage is attached to said frames via brackets, the elevating stage is hoisted in the axial direction of the masts by the drive units by means of a rack-and-pinion hoist mechanism, a mast assembly of a prescribed height is constructed by adding masts one by one, and an elevating work platform is assembled; and after a task is completed using said elevating work platform, the elevating

stage is lowered, the extension masts are removed one by one, and the elevating work platform is disassembled.

[0025]

The invention in Claim 6 is a method for assembling/disassembling an elevating work platform inside of a garbage incinerator or inside of a garbage incinerator and a boiler that is connected to said [garbage incinerator], wherein the elevating work platform assembling/disassembling method is characterized in that multiple masts are attached to a work floor that is installed temporarily inside of the garbage incinerator or inside of the garbage incinerator and the boiler that is connected to said [garbage incinerator], frames equipped with drive units are attached to said masts, an elevating stage is attached to said frames via brackets, the elevating stage is hoisted in the axial direction of the masts by drive units by means of a rack-and-pinion hoist mechanism, a mast assembly of a prescribed height is constructed by adding masts one by one, and an elevating work platform is assembled; and after a task is completed using said elevating work platform, the elevating stage is lowered, the extension masts are removed one by one, and the elevating work platform is disassembled.

[0026]

The invention in Claim 7 is a elevating work platform assembling/disassembling method described under Claim 5, characterized in that a pair of masts are attached in a detachable fashion to the work floor that is installed temporarily inside of the boiler furnace, the frames equipped with the drive units are attached to said masts, the elevating stage is attached to said frames via the brackets, the elevating stage is hoisted in the axial direction of the masts by the drive units by means of a rack and pinion mechanism, the mast assembly of a prescribed height are constructed by adding the masts one by one while connecting them to a furnace wall at fixed intervals, and the elevating work platform is assembled.

[0027]

The invention in Claim 8 is characterized in that in the invention described under Claim 5, 4 masts are attached in a detachable fashion to the work floor that is installed temporarily inside of the boiler furnace, the frames equipped with the drive units are attached to said 4 masts, the elevating stage is attached to said frames via the brackets, the elevating stage is hoisted in the axial direction of the masts by the drive units by means of a rack and pinion mechanism, the mast assembly of a prescribed height is constructed by adding the masts one by one, and the elevating work platform is assembled.

[0028]

As described above, according to the present invention, the elevating work platform can be assembled/disassembled easily and quickly by adding/removing the masts at the elevating stage of the elevating platform while moving the elevating platform up/down.

[0029]

Embodiments of the invention

Embodiments of the present invention will be explained in detail below using figures.

[0030]

Figure 1 is a perspective view of an embodiment of the present invention, Figure 2 is a side view of an extension mast used in the present invention, Figure 3 is a view along the B-B line with arrows in Figure 2, Figure 4 is a side view showing an example of a hoist mechanism for [sic; of] a driving frame and [sic; at] an extension mast used in the present invention, Figure 5 is a view along the C-C line with arrows in Figure 4, and Figure 6 is a diagram showing a condition in which a drive unit is attached to a

mounting hole shown in Figure 4. In addition, Figure 7 is a plan view showing an example of wall connection means used in the present invention, and Figure 8 is a view along the D-D line with arrows in Figure 7.

[0031]

As shown in Figure 1, two opposing elevating work platforms 12 to be assembled/disassembled are provided inside of boiler furnace 11. Because said elevating work platforms 12 are identical, elevating work platform 12 shown in the front will be explained in detail.

[0032]

[The elevating work platform] is configured with work floor (will be referred to as block stage 13a when a pair of extension masts are involved, hereinafter), a pair of extension masts 14 that are installed on block stage 13a in a detachable fashion, elevating stage 15 that is hoisted in the axial direction of the pair of extension masts 14, driving frames 17 that are each equipped with a drive unit at each extension mast so as to hoist elevating stage 15 by means of a rack-and-pinion hoist mechanism, and controller 18. Drive units 16 are connected to controller 18 using cables.

[0033]

Elevating stage 15 is fixed between the pair of driving frames 17 as one body with them via brackets 40.

[0034]

Block stage 13a is constructed by providing stage 21 temporarily above block frame 20 that is provided temporarily inside of boiler furnace hopper (will be referred to as hopper, hereinafter) 19.

Hopper 19 is configured with water pipe walls, and it usually has a small maintenance hatch. Here, the water pipe walls and the maintenance hatch are omitted from the illustration in order to avoid the figure from becoming complicated.

[0035]

In general, during inspection, repair, clinker removal cleaning operations of the furnace walls of hopper 19, the necessary materials are carried in/out through the small maintenance hatch created on a hopper wall. Because the aforementioned operations are likely to become complicated, in the case of the elevating work platform in accordance with the present invention, the quantity of the materials to be carried in/out is reduced drastically.

[0036]

As shown in Figure 2 and Figure 3, 4 mast members 14a are arranged roughly in a quadrangular pattern while connecting them at some distance from each other using a reinforcement material in order to create the mast skeleton of extension mast 14. Rack 23 that constitutes a pinion-and-rack mechanism is attached to extension mast 14.

[0037]

First extension mast 14a is bolted in a detachable fashion to base plate 22 that is bolted to block stage 13a.

[0038]

Guide 24 is utilized for easy installation of extension mast 14a.

[0039]

Base plate 22a for extension is attached to the top end of first extension mast 14a, and the next extension mast 14b is bolted to the top end of mast 14a in a detachable fashion. Said operations are repeated until extension mast 14 of a prescribed height is attained. A pair of extension masts 14, that are formed to the prescribed height, are treated as mast assembly 25.

[0040]

Elevating stage 15 is hoisted in the axial direction of the pair of extension masts 14. Elevating stage 15 is used as a work platform during the inspection, repair, and clinker removal cleaning operations; and equipments and tools necessary for a given work are placed on top of it along with a worker. In addition, materials and a hoisting device necessary for assembling extension masts 14 are placed on elevating stage 15, whereby extension masts 14 are assembled while on elevating stage 15. The controller is also placed on elevating stage 15.

[0041]

Thus, elevating stage 15 with an enough area for the work with said [materials and the equipments] is used. However, because the area of elevating stage 15 is limited, 1.5 m long mast members 14a are connected together for extension mast 14, for example.

[0042]

In addition, a handrail is provided in order to assure safety while on the platform.

[0043]

Driving frame 17 equipped with a drive unit is engaged with each of the pairing extension masts 14, and elevating stage 15 is attached between said pair of driving frames 17 as one body with them via brackets 40 in order to allow it to be hoisted in the axial direction of the pair of extension masts 14.

[0044]

As such, elevating stage 15 is hoisted in a synchronized fashion while kept level by the rack-and-pinion mechanisms as the drive units of the pair of driving frames 17 are controlled using the controller.

[0045]

Next, an example of the hoist mechanism for [sic; of] the driving frame and [sic; at] the extension mast will be explained in detail using Figures 4-6. Split driving frames 17a and 17b arranged so as to surround the mast skeleton of extension mast 14 configured with 4 mast members 14a are provided as driving frame 17. Driving frames 17 are equipped with drive unit 16, that is used to hoist elevating stage 15 by means of a rack-and-pinion mechanism, at each extension mast 14. Drive unit 16 comprising reducer 27 and AC servo motor 28 is attached to driving frame 17 from the outer side through mounting hole 26. Pinions 29 are attached to the front ends of drive units 16, pinions 29 are turned as drive units 16 are driven and engaged with racks 23 attached to extension masts 14 so as to hoist driving frames, and the elevating stage attached as one body with [the driving frames] is hoisted at the same time.

[0046]

Symbol 30 represents a governor (safety device) that can be used to handle fall prevention, buffering at the bottommost stage, prevention of falling out of the top, upper and lower limits, final limit,

displacement detection, and actions to be taken in the events of an excessive load and emergency descending.

[0047]

In addition, guide rollers 31 in contact with 4 mast members 14a are provided at the top and the bottom parts of driving frame 17 in order assure smooth hoisting.

[0048]

In addition, when a pair of extension masts 14 are involved, wall connections of the kind shown in Figure 7 and Figure 8 are established based on the estimate that mast 14 is 10 m high. Orthogonal clamp 32, for example, is used as a means for the wall connections. Orthogonal clamp 32 comprises clamp main body 32a and mount 32b.

[0049]

Orthogonal clamp 32 is attached to reinforcement material 33 provided between 2 mast members 14a that face a furnace wall. Because the furnace wall comprises multiple water pipes 35 and fins 35 that are provided between them, locking plate 36 is welded to fin 35, support member 37 for locking plate 36 is clamped by orthogonal clamp 32 in order to connect extension mast 14 with the wall. Locking plate 36 is fused off during the disassembling.

[0050]

The wall connection is used to prevent the masts from rocking when a pair of extension-type platforms are involved, and it is not usually needed when 3 or more pairs of extension-type platforms are involved.

[0051]

In addition, in the case of elevating work platform 12, controller 18 is installed on elevating stage 15 in order for a worker not only to hoist elevating stage 15 but also to perform all operations necessary for assembling/disassembling, inspection, and so forth. A pendant switch is used for easy operation.

[0052]

Here, because a single worker performs such operations by himself/herself without any other worker working at a different location (for example, above or below), he/she won't be affected at all.

[0053]

Elevating work platform assembling/disassembling method in accordance with Figures 1-8 will be explained in detail.

[0054]

During the assembling of elevating platform 12, first, block stage 13a is constructed temporarily inside of boiler furnace 11. Base plate 22 is fixed at a prescribed position on block stage 13a. First extension mast 14 is bolted to base plate 22 in a detachable fashion.

[0055]

When installing, extension mast members 14a constituting extension mast 14 are bolted to base plate 22 using the hoisting device while using guides 24 as [reference points for] estimation.

[0056]

Driving frames 17 are engaged in a hoistable fashion with the pair of extension masts 14 that are installed on block stage 13a. Driving frames 17 are of a split-type, and they are installed so as to surround extension masts 14. Driving frames 17 are equipped with drive units 16, and driving frames 17 are hoisted in the axial direction of masts 14 as pinions 29 of drive units 16 are engaged with racks 23 of extension masts 14 and driven.

[0057]

Elevating stage 12 is attached to the pair of driving frames 17 via brackets 40. Elevating stage 12 is hoisted together with driving frames 17 as drive units 16 are driven. Upon arriving at a prescribed position, extension mast members 14a brought along are added on top of mast members 14a of extension

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masts already installed using the hoisting device. The pair of extension masts 14a [sic; 14] are extended to a prescribed height in said manner. In the meantime, orthogonal clamps 32 are used for establishing connections with the walls at intervals of approximately 10 m.

[0058]

Once extended to a prescribed height, the extended extension masts 14 are treated as mast assembly 25.

[0059]

Once the assembling work is completed, inspection, repair, and cleaning operations of the inner walls of the boiler furnace are carried out while hoisting the elevating stage. After the work is completed using the elevating platform, the elevating platform is disassembled.

[0060]

During the disassembling of the elevating platform, the extension masts are removed one by one by lowering the elevating stage in order to disassemble the elevating platform. In this case, the parts connected to the walls are fused off.

[0061]

According to the in-furnace elevating work platform of the present invention, the assembling work that used to take 7 days, and another 7 days for disassembling, in the past can be completed in 1 day each for assembling and disassembling. Also, because such an operation as an inspection can be performed flexibly by operating the elevating stage up and down, so that the labor for the inspection operation can be reduced significantly.

[0062]

Figure 9 is a perspective view of another embodiment of the present invention.

[0063]

Parts common to those in Figure 1 are assigned with the same reference symbols, and their explanation is omitted partially. Elevating work platform 38 is installed in a detachable fashion on work floor 13 that is constructed temporarily inside of boiler furnace 11. Elevating work platform 38 utilizes mast assembly 25 comprising 4 extension masts 14. Because elevating stages 39 are formed into one body as they are attached to respective driving frames 17, they are hoisted simultaneously in the axial direction of mast assembly 25 comprising 4 extension masts 14 by the rack-and-pinion mechanisms of drive units 16 of driving frames 17 installed at respective extension masts 14. Operation is controlled

using controller 18. Because mast assembly comprising 4 extension masts 14 is provided for elevating work platform 38, elevating stages 39 do not require any wall connections.

[0064]

Although cases in which the elevating work platform installed inside of the boiler furnace had 2 and 4 extension masts, respectively, were described in the embodiments given above, [the present invention] can be likewise applied to a mast assembly comprising 3 or 5 [extension masts].

[0065]

Figure 10 is a cross-sectional side view when the platform of the present invention is applied to a garbage incinerator.

[0066]

The garbage incineration system is configured with garbage incinerator 41 with stoker 42 and boiler 43 that utilizes a high-temperature exhaust gas generated by garbage incinerator 41' wherein primary furnace 46, secondary furnace 47, and tertiary furnace 48 are provided inside of garbage incinerator 41 in order to remove airborne ash contained in the exhaust gas by adjusting the temperature of the exhaust gas. In the case of elevating work platform 49 in accordance with the present invention, elevating stages of elevating work platforms 49a, 49b, and 49c are constructed inside of said furnace in order to inspect, repair, and undertake clinker removal of the inside walls and the ceilings inside of primary furnace 46, secondary furnace 47, and tertiary furnace 48 while on the elevating stages. Symbol 44 represents a main ash discharge port, and 45 represents a hopper. Above, secondary furnace 47 and tertiary furnace 48 are usually treated as boilers connected to garbage incinerator 41.

[0067]

As is clear from the aforementioned embodiments, the following effects can be achieved by the present invention.

[0068]

Because the construction materials can be assembled/disassembled while on the work floor and the elevating stages, high-elevation labor can be reduced drastically. Because the driving frames are hoisted using the rack-and-pinion mechanisms of the extension masts so as to hoist the elevating stages attached as one body with the driving frames at the same time, no rocking takes place. However, when the estimated height of the extension masts is in excess of 10 m, connections were established with the walls in order to eliminate rocking completely. Sliding frames and a panel-like handrail were utilized in order to reduce the weight of the elevating stages over other kinds of platforms while maintaining their strengths. Because only the elevating stages were used for the work platforms, the quantity of components was able to be reduced drastically. Therefore, the assembling/disassembling was simple and quick, and the work time was able to be reduced significantly.

[0069]

Effect of the invention

As described above, due to the simple structure of the present invention, that is, the mast assembly comprising the multiple pairs of extension masts is installed on the work floor, and the elevating stages to be hoisted in the axial direction of the mast assembly and the driving frames equipped with the drive mechanisms for attaching the elevating stages and hoisting them using their the rack-and-pinion mechanisms provided at the respective extension masts are provided, high-elevation labor can be reduced, rocking can be eliminated, the weight can be reduced over other kinds of platforms, the

quantity of components can be reduced, simple and quick assembling/disassembling can thus be realized, and the work time can be reduced significantly.

Brief description of the figures

Figure 1 is a perspective view of an embodiment of the present invention.

Figure 2 is a side view of an extension mast used in the present invention.

Figure 3 is a view along the B-B line with arrows in Figure 2.

Figure 4 is a side view showing an example of a hoist mechanism for [sic; of] a driving frame and [sic; at] an extension mast used in the present invention.

Figure 5 is a view along the C-C line with arrows in Figure 4.

Figure 6 is a diagram showing a condition in which a drive unit is attached to a mounting hole shown in Figure 4.

Figure 7 is a plan view showing an example of wall connection means used in the present invention.

Figure 8 is a view along the D-D line with arrows in Figure 7.

Figure 9 is a perspective view of another embodiment of the present invention.

Figure 10 is a cross-sectional side view when the platform of the present invention is applied to a garbage incinerator.

Figure 11 is a cross-sectional view showing an example of a conventional in-furnace scaffolding device.

Figure 12 is a cross-sectional view along the A-A line in Figure 11.

Explanation of the reference symbols

| | |
|--------|-------------------------|
| 1 | Boiler furnace |
| 12, 38 | Elevating work platform |

| | |
|----------|--------------------------|
| 13 | Work floor |
| 13a | Block stage |
| 14 | Extension mast |
| 14a, 14b | Mast member |
| 15, 39 | Elevating stage |
| 16 | Drive unit |
| 17 | Driving frame |
| 18 | Controller |
| 19 | Hopper |
| 20 | Block frame |
| 21 | Stage |
| 22, 22a | Base plate |
| 23 | Rack |
| 24 | Guide |
| 25 | Mast assembly |
| 26 | Mounting hole |
| 27 | Reducer |
| 28 | AC servo motor |
| 29 | Pinion |
| 30 | Governor (safety device) |
| 31 | Guide roller |
| 32 | Orthogonal clamp |
| 32a | Clamp main body |
| 32b | Mount |

| | |
|-------------------|--------------------------|
| 33 | Reinforcement material |
| 34 | Water pipe |
| 35 | Fin |
| 36 | Locking rod [sic; plate] |
| 37 | Support member |
| 40 | Bracket |
| 41 | Garbage incinerator |
| 42 | Stoker |
| 43 | Boiler |
| 44 | Main ash discharge port |
| 45 | Hopper |
| 46 | Primary furnace |
| 47 | Secondary furnace |
| 48 | Tertiary furnace |
| 49, 49a, 49b, 49c | Elevating work platform |

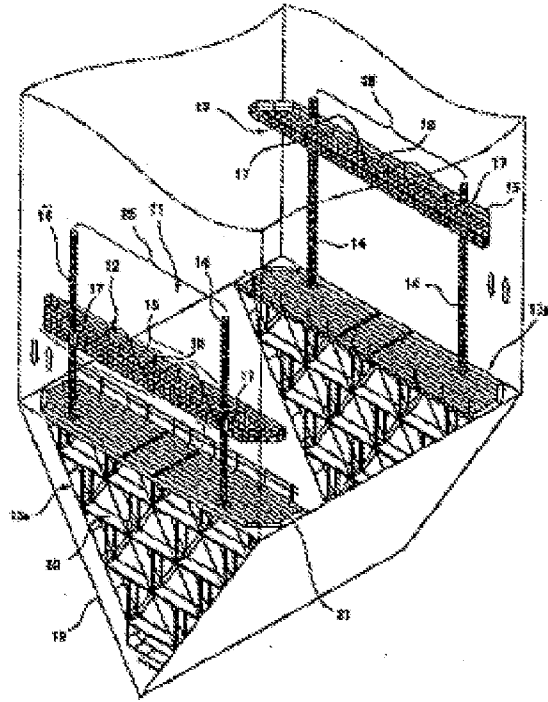


Figure 1

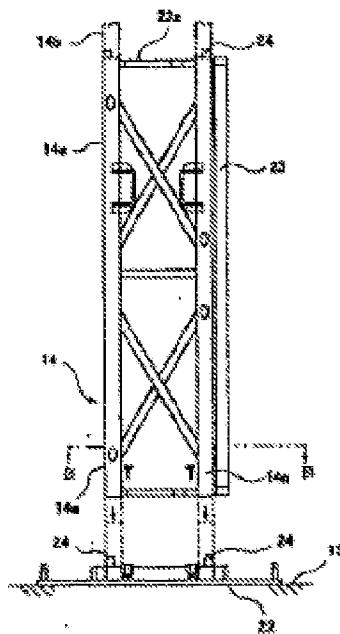


Figure 2

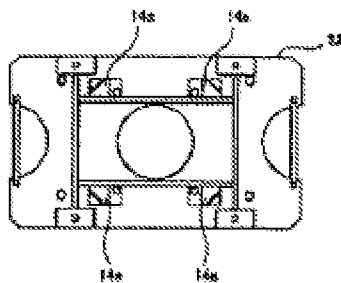


Figure 3

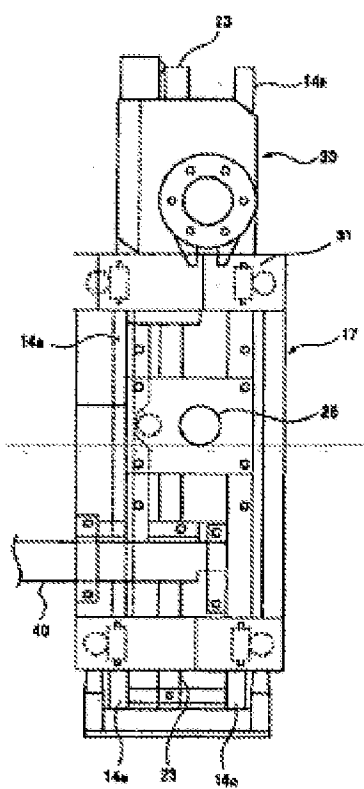


Figure 4

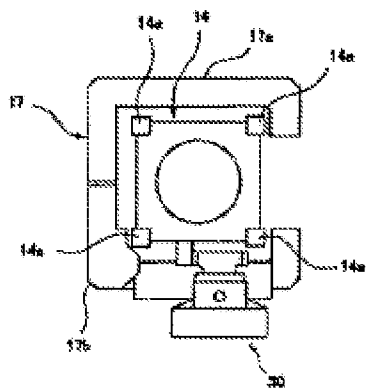


Figure 5

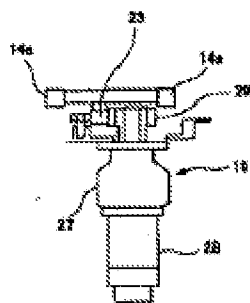


Figure 6

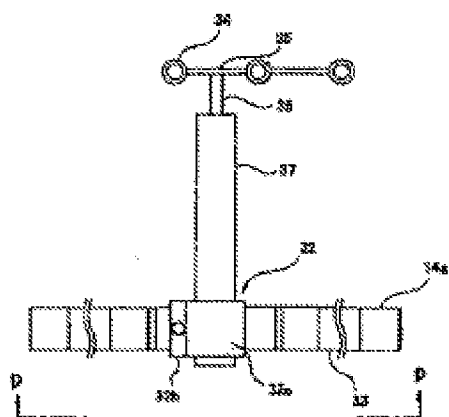


Figure 7

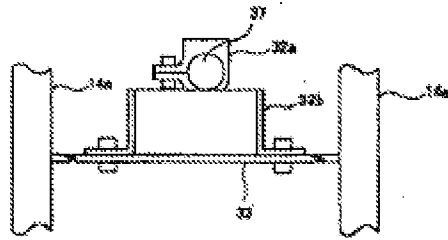


Figure 8

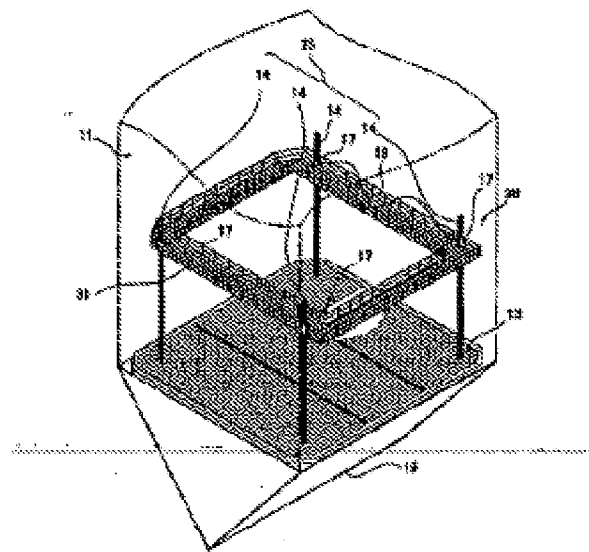


Figure 9

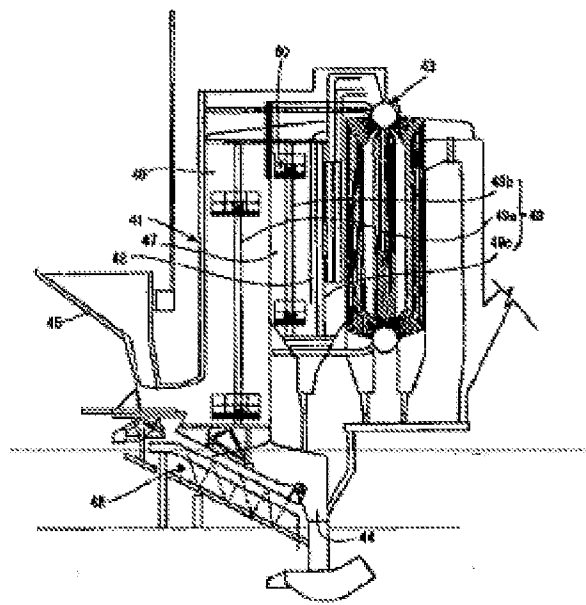


Figure 10

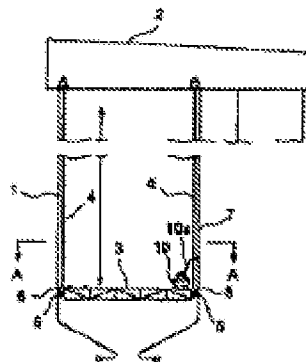


Figure 11

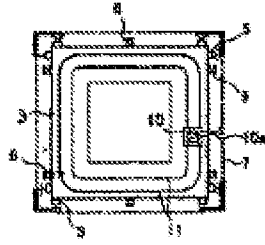


Figure 12